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1. Objective and scope

The aim of this standard is to provide a quality guideline to supplier and /or manufacturer of LED lights, including quality requirements and recommendations to better assure the conformed products to our customers and avoid blocking delivery and/or rejection of batch during Pre-Shipment Quality Control Inspection (PSQCI), by SC&COE which definitively affect to punctuality of deliveries and will make extra costs in different aspects to all parties.

2. General description of LED floodlights

Important remark: all products require specific design of packaging and artworks. Color box is required. The packaging information is provided in other different document.

a. LED floodlights 220V 50Hz

i. Input power: 10 W, 20 W, 30 W, 50 W, 100 W and 150 W

ii. Luminous flux range (lumens):
1. 10 W LED: 800 lm – 1,000 lm
2. 20 W LED: 1,600 lm – 2,100 lm
3. 30 W LED: 2,600 lm – 3,100 lm
4. 50 W LED: 4,700 lm – 5,100 lm
5. 100 W LED: 9,700 lm – 10,100 lm
6. 150 W LED: 14,000 lm – 14,500 lm

iii. Color temperature range:
1. Cool white lighting: 5,000 ºK - 6,500 ºK
2. Warm white lighting: 2,700 ºK - 3,300 ºK

iv. Body:
1. Material: Aluminum
2. Color coated: usually light grey (to be agreed previously by parties)

v. IP grade of the LED light: IP65 (at least)

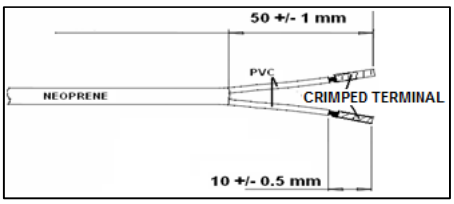
vi. Power cord:
1. Cable: length according as per request, H05RN-F 3G0.75mm^2 up to 100W.
2. Plug: German straight plug IP44.
3. Preferred quality certificate: <VDE>

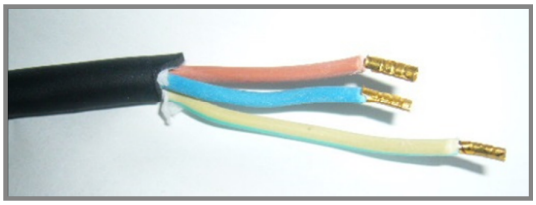
vii. “U” shape iron bracket, enable to be fixed on optional stands

viii. Stand with handle (with plastic ergonomic handle assembled) to be agreed for each power.

ix. Special specification for lights with motion sensor “PIR”:
1. Motion detection distance to turn ON: 9 m. - 20 m (sensor´s capability depends on specification agreed)
2. Adjustable buttons regulators required for motion sensor:
   a. SENS: to adjust sensibility level of motion detection
   b. TIMER: to adjust time light ON, from 6 seconds to 10 minutes.
   c. LUX: to adjust light level to activate sensor

3. Cable H05RN-F 3G0.75mm^2 with no plug is required. The end of wires must be bare without insulation but crimped ready for connection according to the following figure and picture:





b. LED floodlights with stand and rechargeable Li-Ion battery

i. **Light with battery embedded in the body** (not removable by final user)

1. Input power: 10 W and 30 W
2. Luminous flux range (lumens):
   a. 10 W LED: 650 lm – 800 lm
   b. 30 W LED: 2,100 lm – 2,500 lm
3. Color temperature range: (only cool white lighting) 5,000 ºK - 6,500 ºK
4. Switch ON-OFF.
5. Body made of aluminum and black coating.
6. Lighting time with full charged battery: 4 hours
7. Charging time:
   a. 10 W LED: 5 hours – 6 hours
   b. 30 W LED: 6 hours – 7 hours
8. Accessories included:
   a. Charger (input AC 220 V- 50Hz)
   b. 12V DC Car charger
   c. Stand with handle: black coating iron (handle with proper black polyurethane foam)

ii. **Light with removable battery** (with clamps to allow it being enabled to install or remove by user)

1. Input power: 10 W and 20 W
2. Luminous flux range (lumens):
   a. 10 W LED: 650 lm – 800 lm
   b. 20 W LED: 1,300 lm – 1,450 lm
3. Color temperature range: (only cool white lighting) 6,000 ºK - 7,000 ºK
4. Switch ON-OFF.
5. Body made of aluminum and black coating.
6. Lighting time with full charged battery:
   a. 10 W LED: 2.75 hours – 3.5 hours
   b. 20 W LED: 2.75 hours – 3.5 hours
7. Charging time:
   a. 10 W LED: 5 hours – 6 hours
   b. 20 W LED: 5 hours – 6 hours
8. Accessories included in the bulk:
   a. Charger (input AC 220 V- 50Hz)
   b. 12V DC Car charger
   c. Removable battery:
      i. Switch ON-OFF (two modes ON):
         1. Turn ON for lighting.
         2. Turn ON for providing power to USB (connection for charging mobile, tables, smartphones, etc.)
         3. Turn OFF: no power provided by battery (USB connector and LED power OFF).
      ii. Battery specifications: 11.1V DC – 2,200 mA
9. Optional accessory for final user (in separate packaging): one extra removable battery

3. Pictures and drawings of LED floodlights:

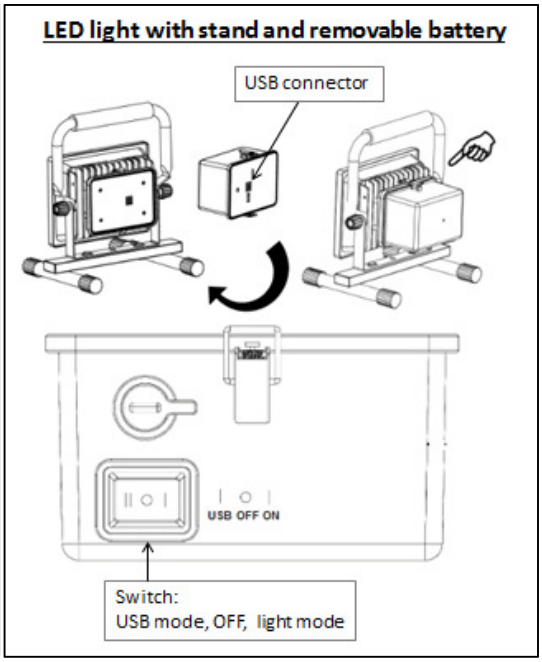
LED floodlights (grey color coated)

LED floodlights w/motion sensor

Floodligh with handle stand

LED floodlights w/stand and Li-Ion rechargeable battery

LED light with stand and removable battery



4. Required accomplishment of standards

a. All products will meet CE and RoHS directives as well. CE mark shall be provided in all artworks. Supplier shall provide self-certificate of Declaration of Conformity.

b. Supplier shall release a self-declaration of CE conformity for each product model to officially state that all CE safety directives are accomplished.

c. The following specific standards for LED lights are required to be accomplished:

i. EN 60950:2000 – Safety of information technology equipment
ii. IEC 60529:2004 – Ingress Protection Grades (IP GRADE)
iii. EN 62493:2010 – Assessment of lighting equipment related to human exposure to electromagnetic fields
iv. IEC 62471:2008 – Photo-biological safety of lamps and lamp systems
v. EN 61047 – Electronic transformers for lamps safety
vi. 2006/66/EC – Batteries and accumulators.

d. It is especially important the supplier to provide two specific certifications:

i. Accomplishment of **EN 62493:2010** standard. In 2010, the Electromagnetic field (EMF) testing was introduced as a new access requirement for lighting equipment imported into the European Union. In order to assess the effects of exposure to electromagnetic radiation and protect the health of consumers, the EU introduced the EN 62493:2010 standard, which becomes mandatory in February 2013.
ii. Accomplishment of **EN 62471:2008** standard. It is a standard to assure no optical radiation hazards, and completely replace the old standard IEC/EN60825.

e. Regarding testing report provided by supplier it is preferred to release testing reports according to the LM-80 standard.

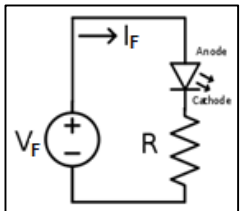
5. Basics and fundamentals of LED lights

a. LED circuit and specifications

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a basic "pn-junction diode", which emits light when electrical current goes through to be activated.

The LED for using in lighting industry requires more precise current and heat management than compact fluorescent lamp sources of comparable output.

So a LED circuit is an electrical circuit used to power a light-emitting diode or LED. The circuit must provide enough current to light up the LED at the required brightness, but must not allow so much current to flow as to damage the LED (overcurrent). The LED has a roughly constant voltage drop over a wide range of operating current, so a small increase in applied voltage will greatly increase current. Electronics circuits (DRIVER) are required especially when driving high-power LEDs for illumination, where regulation of the current through the LED is required.



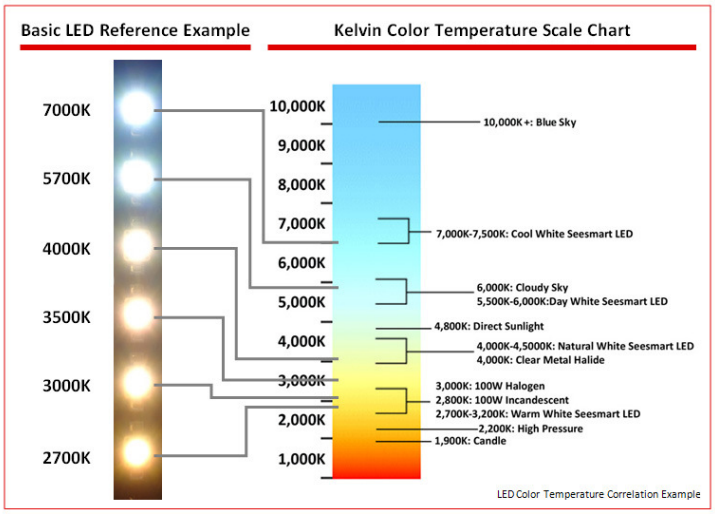
Simple circuit diagram which emulates LED

It is important to emphasize that what we usually name as LED in lighting is really an array of combined single LED embedded in an epoxy package. That is known in lighting as COB LED (chip on board), however also we can find out in market the technology version based on SMD LED, an abbreviation for Surface-Mount-Device Light-Emitting Diode, is a type of LED module that uses Surface-mount Technology (SMT) to mount LED chips on printed circuit boards (PCB).

When choosing LEDs for particular lighting applications it is necessary to comprehend the different LED specifications or LED parameters.

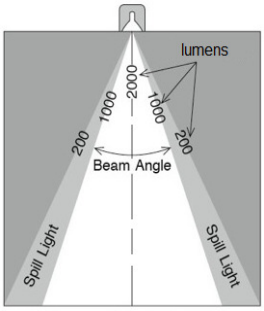
There is a variety of different LED specifications, each of which will have an effect on the choice of the particular LED used. Some of the major LED specifications are outlined as follows:

- **Forward Current (I_F):** it is the current which flows across the LED's leads, from anode (+) to cathode (-), in order for the LED to receive sufficient current to power on.
- **Peak Forward Current ($I_{F(PEAK)}$):** it is the maximum overcurrent during a short period of time (about 0.1 ms) that an LED can be fed without being damaged or destroyed.
- **Forward Voltage (V_F):** it refers to the voltage drop that occurs when an electrical current passes through the LED. It is generally independent of the amount of current passing through the LED or variation shall be small.
- **Power Dissipation (P_D):** this parameter is normally considered as a secondary characteristic. The Power Dissipation consists of resistive and radiated power as well. Basically the most of dissipated power will be through resistive effect of LED so that it is transformed into heat (about 90%).
- **Reverse Voltage (V_R):** it is opposite voltage which does not allow current through the LED up to a point. Reverse voltages in excess of the maximum can cause LED failure and permanent damage.
- **Operating Temperature Range (T_{OPR}):** it refers to the temperature at which LED operates without damaging performance or reducing its lifespan.
- **Storage Temperature Range (T_{STG}):** it refers to the required temperature conditions to store LED. If storage temperature of LED is out of the required range by manufacturer then LED characteristics may be damaged.
- **Manual Soldering Temperature (T_{MSOL}):** it is temperature of the soldering iron to solder LED junctions with wires during a maximum soldering time. It is required qualified and skillful workers to solder LED. If soldering time or temperature is over the upper limits of range then damage shall likely happen. The soldering temperature below the lower limits shall make failures such lack of contact, cracking and weak joint (vibration might break it).
- **Soldering on heat plate (T_{HSOL}):** temperature range to solder with a soldering heat plate
- **ESD sensitivity:** ESD stands for Electrostatic Discharge. Simple contact of a finger to the leads of LED chip allows the body to discharge Electrostatic power, possibly causing LED damage or negative effects. The model used to simulate this event is the Human Body Model (HBM) and it is measured in Volts.
- **Color temperature:** it is a measurement that indicates the degree of color being emitted from a light source in degrees Kelvin.

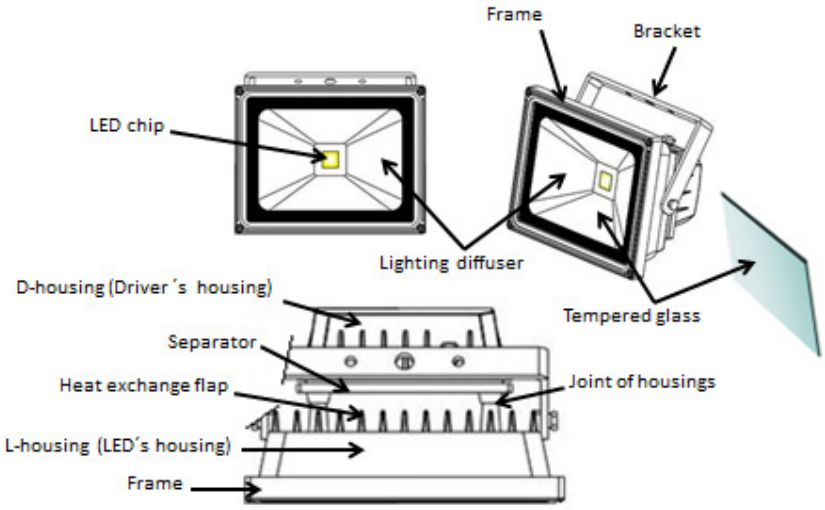


- **Luminous flux** or also called **luminous power**: is the measure of the perceived power of light. It differs from radiant flux, the measure of the total power of electromagnetic radiation (including infrared, ultraviolet, and visible light), in that luminous flux is adjusted to reflect the varying sensitivity of the human eye to different wavelengths of light. The SI unit of luminous flux is the lumen (lm). One lumen is defined as the luminous flux of light produced by a light source that emits one candela of luminous intensity over a solid angle of one steradian.

- **Luminous intensity:** a measure of the wavelength-weighted power emitted by a light source in a particular direction per unit solid angle, based on the luminosity function, a standardized model of the sensitivity of the human eye. The SI unit of luminous intensity is the candela, an SI base unit. Luminous intensity should not be confused with another photometric unit, luminous flux, which is the total perceived power emitted in all directions. Luminous intensity is the perceived power per unit solid angle. If a lamp has a 1 lumen bulb and the optics of the lamp are set up to focus the light evenly into a 1 steradian beam, then the beam would have a luminous intensity of 1 candela. If the optics were changed to concentrate the beam into 1/2 steradian then the source would have a luminous intensity of 2 candelas. The resulting beam is narrower and brighter, though its luminous flux remains unchanged. Luminous intensity is also not the same as the radiant intensity, the corresponding objective physical quantity used in the measurement science of radiometry.
- **LED angle of view or beam angle**: Beam angle refers to the angle between the two planes of light where the intensity is at least 50% of the maximum intensity at center beam.
- **Field angle:** Field angle refers to the angle between the two planes of light where the intensity is 10% (or less) of the maximum intensity at center beam. This is sometimes referred to a ghosting or spill, and it is not considered usable light.



b. Main structure of LED floodlights. Parts glossary.



6. Basics of this quality standard. Recommendations to avoid failures and unexpected shorter lifespan

Expected lifespan of floodlight under standard operation and correct installation according to the experts' recommendation is about 50,000 hours (it is 5.70 years lighting 24 hours/day). Anyway, the realistic lifespan of a LED floodlight shall depend on different other factors which are divided in two root cause categories:

1. Category A: causes by manufacturer and vendors
2. Category B: causes by user (wrong installation and/or use)

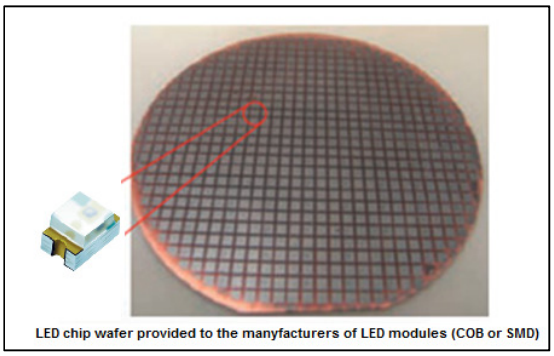
We will focus on the category "A", anyhow, we should emphasize that a wrong installation or mistaken use in market could be caused because of a poor technical information and lack of recommendations to the customer about how to use such LED floodlight in the best condition to assure the longest lifespan, so the LED floodlight manufacturer or just the vendor can also influence on the right use by customers.

So, in conclusion, in spite of using high quality standard LED, lifespan shall depend on quality of all other parts and components and how the quality control during product assembly process is. We will see in next pages how to manage quality to assure right quality required by customer.

7. Quality standard of parts and components

a. LED chip: The LED chip is provided in a chip wafer ready for the manufacturing of packaging structure: LED COB or LED SMD. See the right picture.

The LED chip is picked up from the wafer to be placed in the lighting LED package module.



LED chip wafer provided to the manyfacturers of LED modules (COB or SMD)

i. Preferred LED chip manufacturers (*):

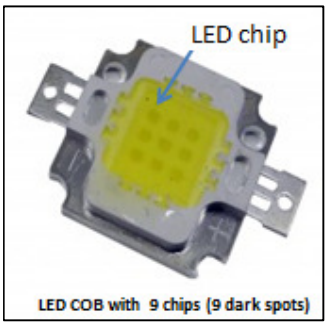
USA / Japan	TAIWAN	CHINA
CREE (USA)	EPISTAR	SANAN, Xiamen Sanan Optoelectronics Co. Ltd. Xiamen
NICHIA (Japan)	OPTO TECH	SILAN, Hangzhou Silan Azure Co. Ltd. , Hangzhou
TOYODA GOSEI (Japan)	TYNTECK	INSPUR, Shandong Inspur Huaguang OptoelectronicsCo. Ltd., Jinan
BRIDGELUX (USA)	HUGA	CHANGELIGHT, Xiamen Changelight Co., Ltd., Xiamen
	ARIMA	EPILIGHT, Epilight Technology Co., Ltd., Shanghai
	FOREPI	HC SemiTek, Wuhan HC SemiTek Co. Ltd., Wuhan
	GENESIS PHOTONICS	AQUALITE, Aqualite Co., Ltd., Wuhan
	TEKCORE	APTE, ElectronicS APT (Guangzhou) Limited
	CHIMEI	NEON-NEON, Neon-Neon Holding Limited, Hong Kong

(*) Quality documents, technical data sheet and traceability evidences will be always required for quality approval.

ii. Other LED manufacturers can be accepted but previous test and approval of documentation is required (Quality certificates and technical data sheet). Previous factory audit might be necessary too.

b. LED COB Module

LED COB (chips on board) , is a LED packaging formed with a quantity of LED chips, which makes one lighting module. If someone looks at this module, it is possible to see some dark spot. Every dark spot is a LED chip connected with the other to form a LED chip matrix. See te following picture to understand the general steps of LED COB manufacturing.



LED COB with 9 chips (9 dark spots)

c. LED Driver:

The design and topology of the LED driver shall provide current stability (Forward Current drive, I_F) as such driver ideally should be a constant current source. Since the luminous flux of LEDs also varies, as a function of the manufacturing process, which means that it is necessary the DRIVER to account for variations of current and the forward voltage.

Additionally DRIVER should include safety and optimization functions:

- to automatically detects input voltage variations and correct IF.
- to prevent from over-temperature by optimizing IF level
- to prevent from electromagnetic interferences

The lifespan of LED floodlight shall definitively depend on DRIVER´s design, quality of hardware and quality assurance of manufacturing process.

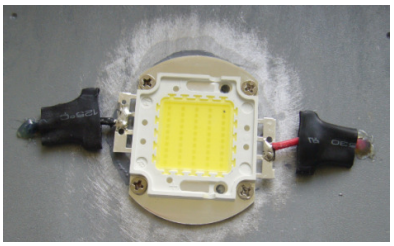
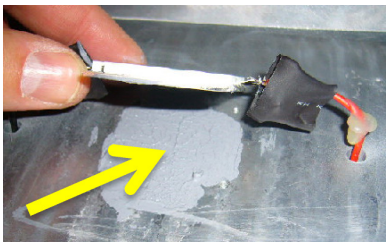
Requirements for quality approval of a driver:

- Technical data sheet and manufacturer certification.
- Quality and test reports: CE, EMI, FCC, RoHS and IP rating (IP65, IP67...)
- Manufacturer and model/part number will clearly printed or stamped on DRIVER´s housing to assure traceability between part and certification.

d. Other parts. Manufacturer information and quality certification is required for the following parts:

1. **Power cord, plug and wires**.
   It is required VDE certification of the whole set of power cord (cable + plug), with at least IP44 plug.


2. **Thermal conductive paste.**
   The right choice of the thermal conductive paste applied between the LED base plate and surface support shall dramatically help heat comes out from LED. It really influences on lifespan of product.

The highest thermal conductivity and lowest thermal resistance, the better performance of the thermal paste.
Manufacturer and data sheet is required to get quality approval of samples.
The recommended properties of the proper thermal conductive paste should be:

- Thermal conductivity (W/ m^2 ºK): 5 ±0.5
- Dielectric strength (KV/mm): 4.2 ±0.5
- Operating temperature range (long term): -40 ºC – 180ºC
- Expiry period (storage time from manufacturing date): 12 – 18 months **(*)**

(*) It is very important to control the storage conditions (temperature range and %RH), and time in stock. The manufacturer shall duly provide storage directions and manufacturing date and expiry period. Once the expiry period of storage is over then such paste can not be applied as properties are deteriorated.

3. **Terminal block connection or crimping connectors of wires.**

Terminal blocks will meet the requirements of the Low Voltage Directive put forth by the European Union (CE) and RoHS. VDE is a preferred certification but it is not a requirement. RoHS certification is required to get quality approval.

Data sheet by manufacturer is required but VDE certification is required only if VDE mark is printed on the terminal block. All connections must be strong enough and meet CE.

4. **Screws**

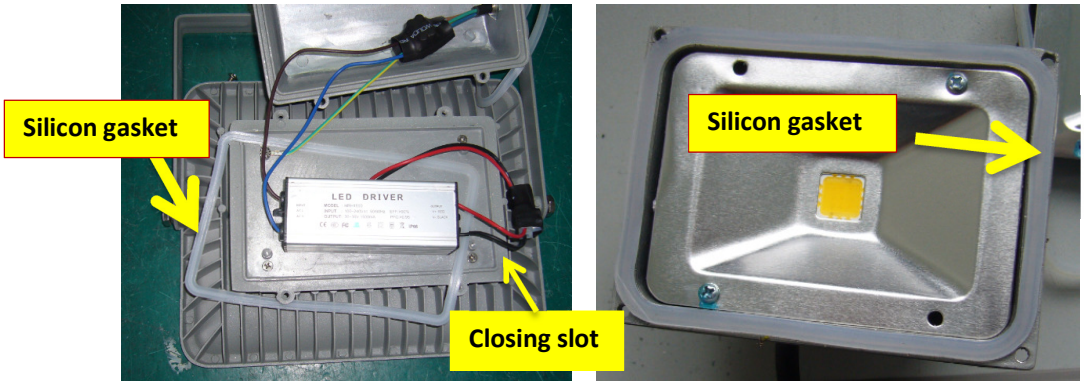
It is preferred tamper resistant screws with special head to close the D-housing, L-Housing and frame so tighten parts to avoid intentional malfunction, sabotage or inadequate repair by user is highly recommended.

Hard enough screws are required so material specification data from supplier is necessary to get quality approval.

Additionally, it is necessary to previously agree with customer about the final type of tamper screw to assure tools available according to customer´s needs.

5. **Silicon / rubber gaskets**

The gasket or joint to close housing and frame are essential to assure the IP rating. The best material for long-term performance is **silicone rubber**. Silicone withstands the broad temperatures, different weather conditions and a long term outdoor exposure.



It is also necessary to provide a correct gasket in terms of shape and dimensions to ensure correct fitting with the closing slot and then also ensure the required IP rating (at least IP65).

All LED floodlights shall have the International Protection grade of "IP65" - *defined as no ingress of dust; complete protection against contact (dust tight) and water projected in powerful jets (12.5 mm nozzle) against the LED floodlight from any direction shall have no harmful effects (test for at least 3 minutes, 100 liters/min and 1000 kPa at distance of 3 m). Any other superior IP grade should be agreed between customer and supplier.*

The following materials for gaskets are not accepted (prohibited material) in LED floodlights:

Prohibited Material	Color	Gasket effectiveness on outdoor
Closed cell EPDM	Black	It is good sun and UV resistant but it shall take a set and fail if the floodlight keeps long time outdoor exposure
Closed Cell Neoprene	Black	Long term outdoor exposure shall age this material.
Blended cell neoprene (*)	Black	Long term outdoor exposure shall age this material.
PORON®Microcellular Urethane Foam	Black	May eventually wick and / or absorb water and fail

(*) It is tipically blended with other elastomers such as styrenebutadiene rubber (SBR) and EPDM

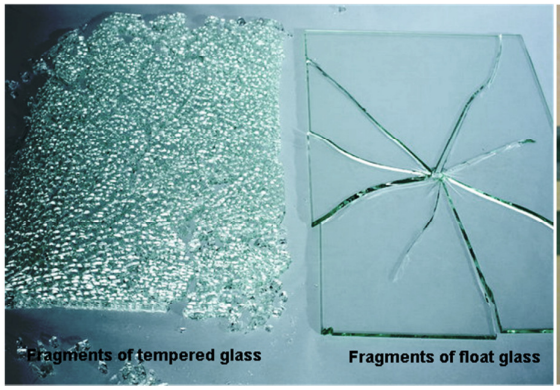
6. **Soldering tin.**
   It is required RoHS soldering materials. It is necessary to provide data sheet and RoHS certificate.

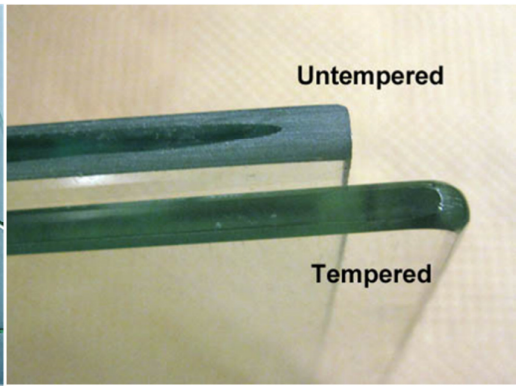
7. **Housing parts (aluminum).**
   No imperfections, surface deformations, cracking or sharp burrs are allowed.

8. **Oxidation resistant coating.**
   It is required RoHS coating (no heavy metals are allowed). It is necessary to provide data sheet and RoHS certificate.

9. **Rechargeable Li-Ion batteries** and its PCB protection module used for LED floodlights. Remark: quality and reliability of rechargeable battery embedded in lights shall definitely affect to lifespan in terms of number of charging cycles and maintenance capacity along time.
   Requirements for quality approval:
   - Technical data sheet and manufacturer certification.
   - Quality and test reports: CE and RoHS
   - Manufacturer and model/part number will clearly be printed or stamped on battery´s housing to assure traceability.

10. **Tempered glass.** Cracking and visual test is required (Float glass is prohibited).





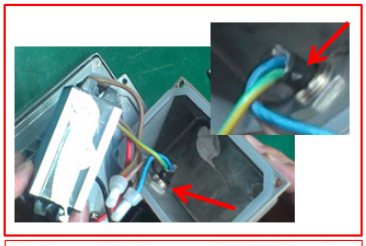
8. Quality standard of whole product and assembly process. Quality requirements during production.

a. Place of parts inside the housing same as the sample approved.

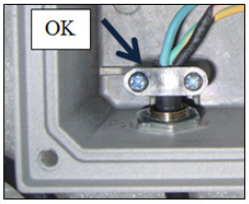
b. Any certificate by a third party to proof CE standard accomplishment must be provided for our approval and inspectors with its corresponding Test Report, which shall include a documented bill of materials, sources and pictures, to better trace and confirm that mass production match with such quality certification.

c. **VERY IMPORTANT**: **NO** change /modification of parts is allowed without previous written authorization by SC&COE, equally a supplier change different from the approved for the approved document and sample is **NOT** allowed **without previous written authorization by SC&COE**. The change of parts or even the change of parts´ place in the assembly set could make different electromagnetic (EM) effect, so EM disturbance and interferences could happen and in consequence the product might not pass EN 62493:2010 safety standard.

d. The **power cord must be strongly fixed** inside the housing to avoid removing the cord (pull out or put in), by means of a recommended clamp like the beside picture. That is quite frequent mistake in many floodlights. See the following pictures to understand what can not pass safety standards (safety non-conformity) and what is correct which pass CE standard.



No clamp to fix the power cable in the housing. It is used fixing paste or glue. That is not allowed.



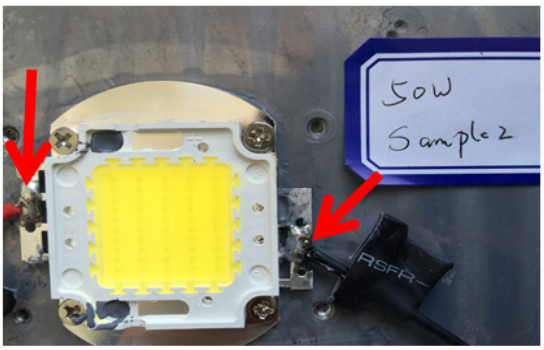
Correct fixing way of power cord by means of a two-screws clamp

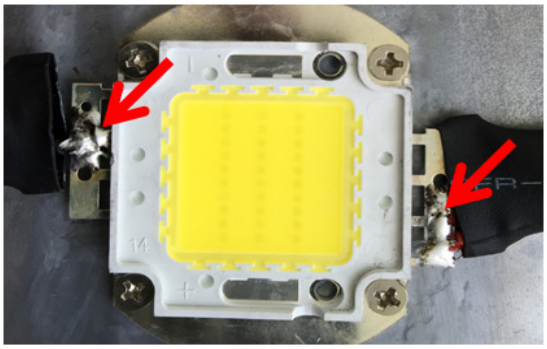
e. Soldering techniques following LED manufacturer recommendations.

i. Carefully soldering techniques of LED junction are required during mass production according to the recommendations by LED manufacturer.

ii. It is required to train and educate workers (qualify workers) to assure correct **soldering technique**. Some specifics remarks and recommendations:

1. LED manufacturer usually recommend temperature and time to solder LED junction (e.g. 350ºC ±20ºC, 3 sec max.). So the LED package might be damaged due to overheating during soldering job.
2. A lack of skill in manual soldering or poor experience of worker might make defective soldering and permanently damage LED chip, so lifespan is dramatically shorter.
3. The below pictures show defective soldering on LED junction (dirtiness due to oxidation and pollution). That is a **major defect** to be avoided in production.

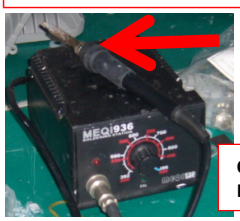




High risk of soldering failure mode due to lack of skills or not enough good soldering technique. We can see non-uniform soldering and dirtiness due to oxidation during soldering.

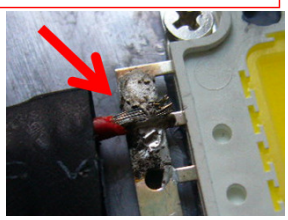
Recommendations/advises to void soldering Failures:

- The higher the tip temperature, the faster oxidation forms. Soldering at temperatures over 460° C causes iron tip to oxidize twice as fast as soldering at 370° C. Adjustment of soldering temperature to the minimum temperature needed to melt the solder and have it flow smoothly. Black dirtiness is the appearance of oxidation during soldering so right technique shall avoid future failures.
- Keep the soldering tip clean but avoid too frequent wiping it on a wet sponge as it causes early tip failure and defective soldering.
- Keep a roll of large diameter on hand to periodically flush and re-tin the soldering iron tip.



Oxidation. Poor maintenance.

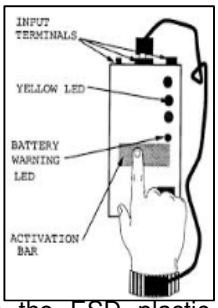
Temperature tester of iron



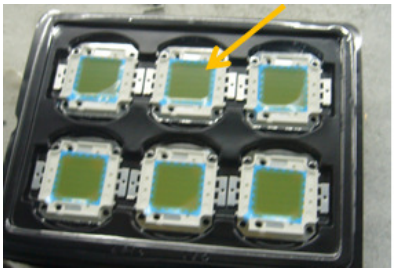
f. <u>ESD protection for handling LED chips</u>:

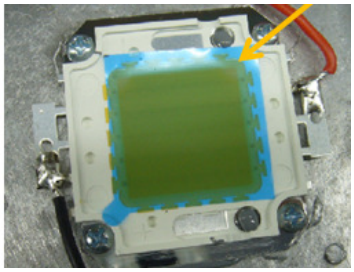
i. All workers, who directly touch and take LED chip along process, from the storage tasks to assembling process, must wear ground bracelet, antistatic wrist strap or ESD wrist strap safely connected to ground.

ii. Effectively test of ground bracelet, antistatic wrist strap or ESD wrist strap are required. Factory should have proper tester device under correct maintenance. See below pictures as examples of ground connection tester and ground bracelet.



iii. It is highly recommended to keep the ESD plastic protection film provided by LED manufacturer during handling and assembling process until it is necessary to test then removed off it at that time by worker with ESD bracelet well connected to ground. See the below pictures.





g. Assembly of gaskets

The work of gasket assembly is easy but it is essential to do it carefully to ensure the IP rating (IP65). The perfect fitting of gasket on slots are required.

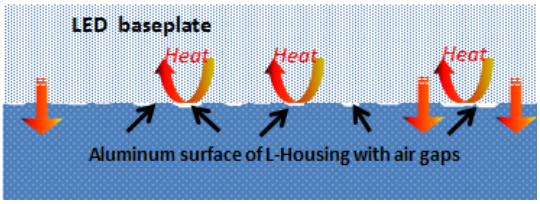
No deformation of gasket or damage is allowed as it shall increase risk of IP rating deterioration.

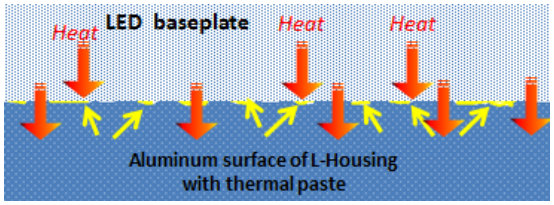
The two sides of housing parts to be closed must be clean, flat, uniform and parallel each other. If any surface deformation or damage on slot then gasket performance shall be dramatically deteriorated (IP rating shall be reduced or eliminated). That is a major Non-Conformity.

h. Procedure for applying the thermal conductive paste

Thermal conductive paste is a very high heat conductive paste that is used between LED bottom surface and aluminum base acting as heat sink of LED to get better heat conduction. It fills in all those microscopic imperfections on the contacting surface that can trap air in them and cause a loss in the heatsink's performance. Air is a very poor conductor of heat.

Anyway, it is highly recommended to make sure that contacting surface (LED baseplate and surface support of L-Housing) are as clean and flat as possible before applying the thermal paste. The less imperfections on support´s surface the better heat exchange and consequently better assurance to meet the expected lifespan and performance maintenance along time. The following figures show the effect.

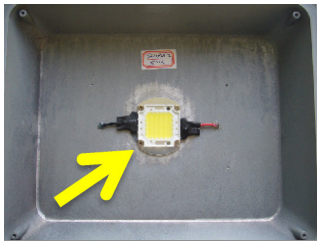


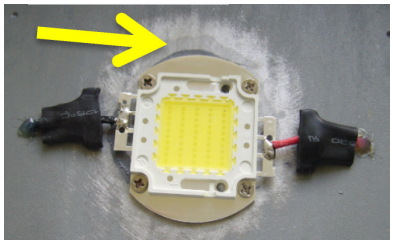


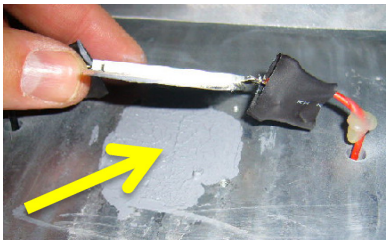
The thermal paste layer has to be as thin as possible to assure no heat resistance increase if too much paste added. So it is also necessary uniform application filling all microscopic imperfections but avoiding too much amount applied as it shall decrease heat conduction and lifespan of LED shall be affected too.

Thermal paste can be applied either to the LED baseplate or to the support surface of L-Housing. This task can be done using a rubber roller. In simple way of application, a rubber roller is normally used like the right picture.


Rubber roller





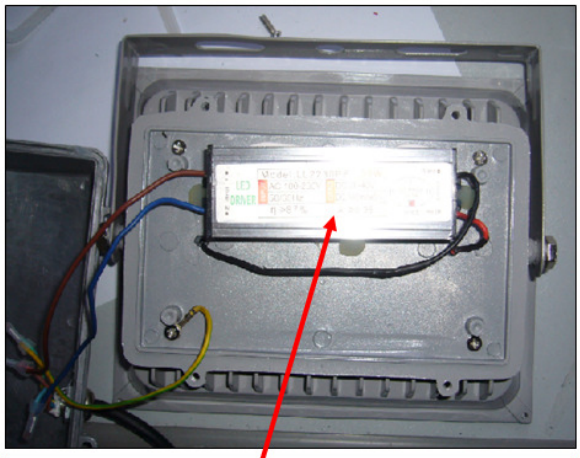


Before applying the thermal paste it is necessary to make sure that support surface is totally clean and flat. Just in case of coated surface, it is necessary to peel off such coating by brushing and polish the surface to minimize the micro fissures and imperfections, then the support surface shall make better contact with the LED baseplate.

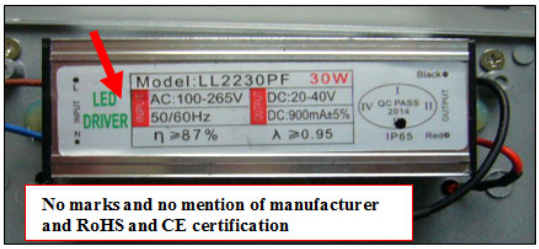
i. **Maintenance of tools and devices** (in particular cleaning and maintenance of soldering iron)

j. **Wire path inside the housing** (connection of LED – driver – power cord).
Wires and cables path inside the housing will be considered for quality approval of samples. The path will be fixed to avoid risk of damage during assembly works and operating time of product.

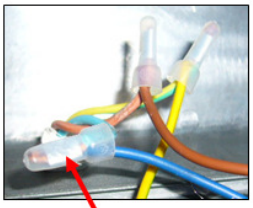
9. Assembly of LED floodlights. Major defects to be avoided.



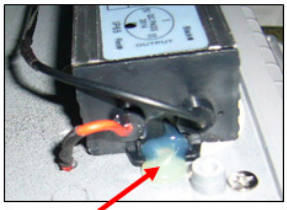
High risk of DRIVER deterioration due to heat directly coming from LED side, so DRIVER directly receives heat on its base. It is highly recommended to change the place of DRIVER and avoid direct heat transferred. For instance, just place DRIVER on the other side of housing farther from heating.



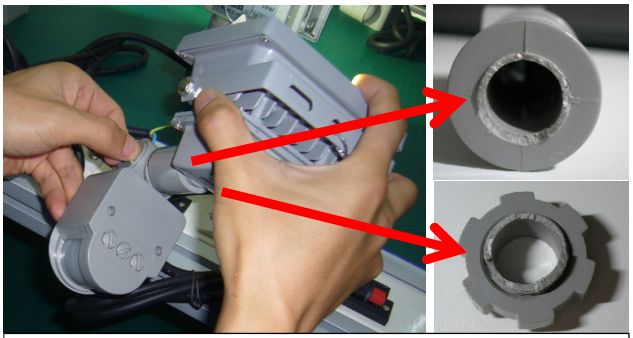
No marks and no mention of manufacturer and RoHS and CE certification



Crimping caps of wire connection are not recommended.



High risk of glue deterioration due to heat transferred from LED, so the driver might be detached from the base and keep loose inside the housing.



Broken plastic joints of PIR mechanism parts.
Broken when it is installed by user

10. Quality control management

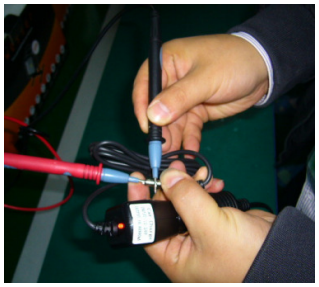
a. Measuring / testing devices to confirm light specifications (lumens, ºK, surface temperature, IP grade and all standard parameters provided to quality approval)

b. Quality Assurance Management

i. Training procedure and records about soldering and ESD protection.
ii. Work instruction sheet or Standards Operating Procedures for each job in line.
iii. Calibration procedure and control of essential measuring devices to assure accuracy of measures.
iv. Switch (if any) shall be smooth to operate and cannot get stuck on any position. Functionality after 100 consecutive times of operation shall be successful.
v. Light shall meet specifications according to the user´s sheet and artwork.
vi. Temperature on any accessible part shall ever not be over 55ºC.
vii. The light shall normally work when plugged into the mains.

c. LED floodlight manufacturer shall have an available Integrating Sphere Meter Equipment to check lumens and other lighting parameters supported by computer (reporting software). Previous calibration is required with calibrated lighting bulbs to delete offset. See example of calibrated bulbs mentioned.

d. Testing of car charger for LED lights (check charger works with DC power supply and multi meter – voltage without load and check car charger works with battery)



Needs: DC power supply + cable with car connection + multi meter + battery

e. Testing of power charger for LED lights (check the charger with rechargeable Li-Ion battery and multimeter)

f. Other essential quality control equipments to be in factory available for measuring and test: multi-meter, programmable DC power supply, Programmable temp & humidity chamber, surface temperature recorder, light life test station,

11. Requirements to get quality approval by SC&COE

a. Before placing any Purchasing Order, it is necessary to get quality approval of each item. Such quality approval consists of:

1. Test of samples to confirm technical specifications
2. Documents required for quality approval:
    a. Specifications data sheet of main parts issued by manufacturer:
        i. LED chip
        ii. LED COB or any other LED lighting module
        iii. LED driver
        iv. Battery and protection PCB module
        v. Wires
        vi. Wire terminal connection
        vii. Thermal grease or paste
    b. Required certificates of main parts and each floodlight model (CE, RoHS, EMC, FCC, IEC 62471:2008 and EN 62471:2008).
3. Traceability of suppliers. All main parts such LED chip, driver and Li-Ion battery will be identified by hallmark printed on parts' surface or by means of stamping marks (manufacturer name or registered logo, model/type or part number same as the certification, quality marks and statutory specifications).
4. The samples tested for approval will be same as the mass production made by supplier to meet the Purchase Order.

b. During production by supplier, SC&COE might visit the factory to audit accomplishment of this quality guidance during production and release Non-Conformity Report if necessary to control corrective / preventive actions by supplier.

c. Pre-Shipment Quality Control Inspection (PSQCI) by SC&COE will be required to get delivery acceptance. PSQCI Report will be released accordingly.